

Assignment 4 : Q1: Report

Question 1 Segmenting a Brain Magnetic Resonance (MR) Image

All required codes are implemented in “myMainScript.m” located in ‘code’ folder of Question 1.

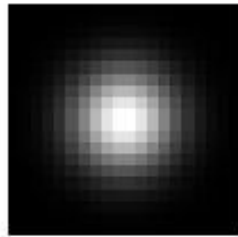
Reporting

Part a

Chosen value of $q = 5$ which we got by optimisation

Part b


Neighbourhood mask = Gaussian (window size = 20 , sigma = 3)



Part c

Initial Membership is uniform across all classes and assumed to be $1/K$ at each pixel within brain for each class. Outside brain it does not matter. Image for the same is shown below. Motivation behind this is, because we don't have any prior information about class of each pixel so it is best to assume uniform.

Membership Images	Class
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<p>Initial membership estimates</p> 	<p>Same for all classes</p>
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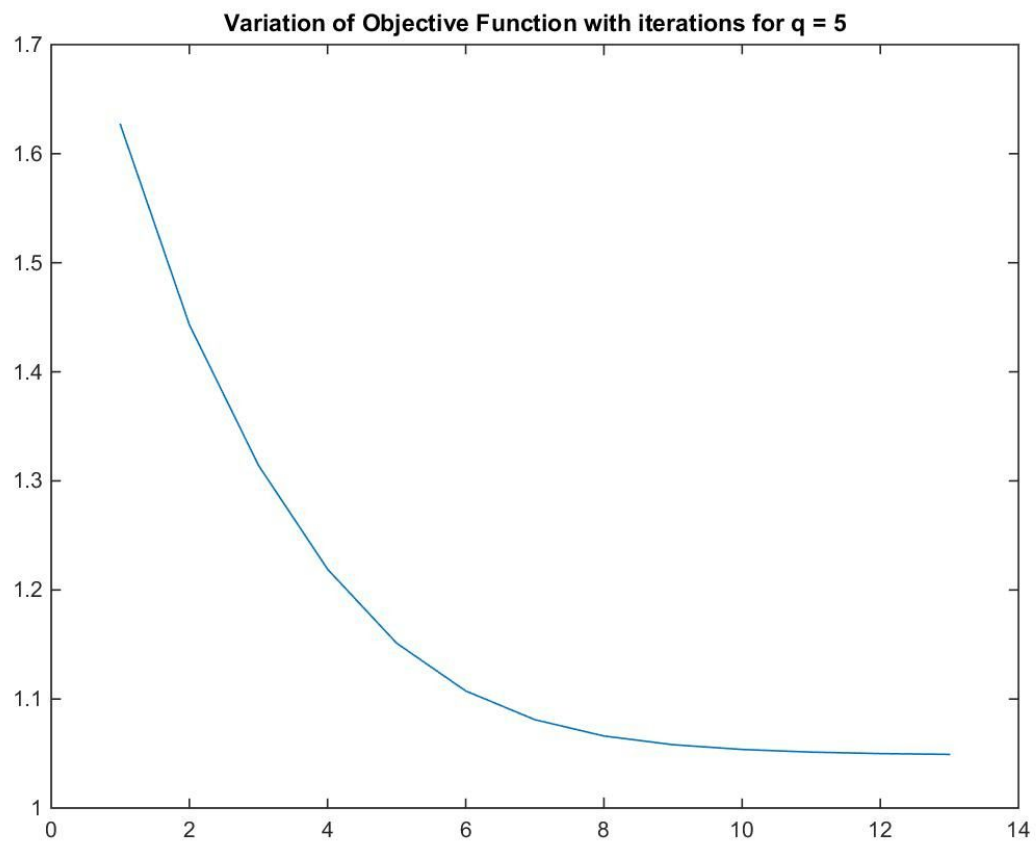
Part d

Initial Estimation of class means = $[0.25, 0.5, 0.75]$

We have chosen some random points among the data as class means with the intuition that they are representative of the data.

Part e

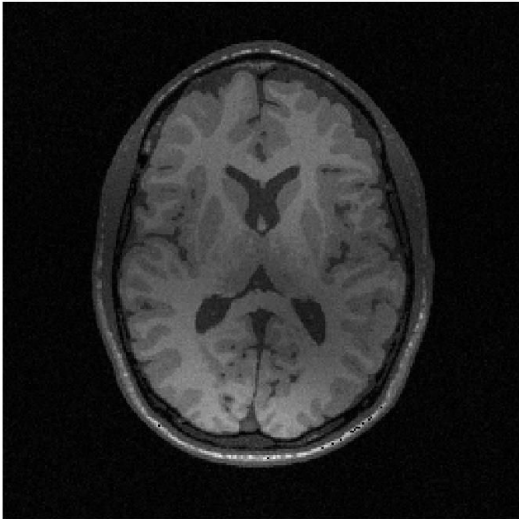
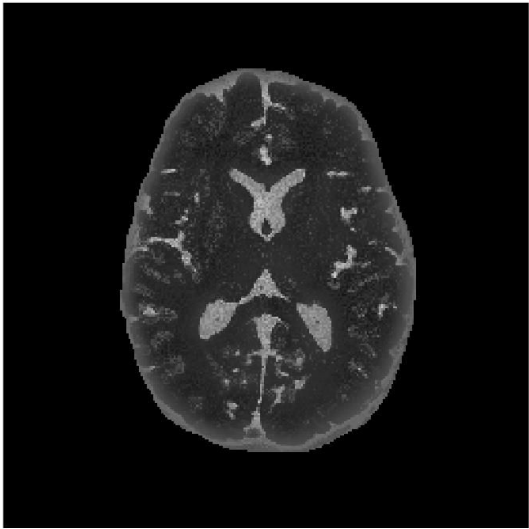
Variation of Objective function is as follows



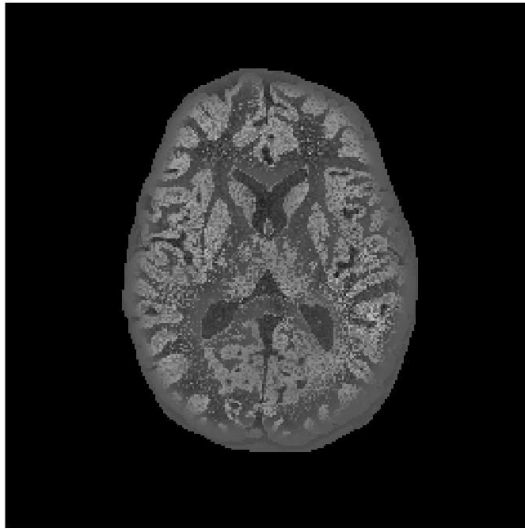
Part f

Optimal Images

Images	Description
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<p>Corrupted Image of brain</p>  An axial T1-weighted MRI scan of a human brain. The image is labeled 'Corrupted Image of brain'. It shows a cross-section of the brain with visible gyri and sulci. There is a noticeable dark, irregular region on the left side of the image (patient's right hemisphere), which appears to be a corruption or artifact in the original image.	<p>Corrupted Image (given input)</p>
<p>Memmbership for first class with $q=5$</p>  An axial T1-weighted MRI scan of a human brain, similar to the one above. It is labeled 'Memmbership for first class with $q=5$ '. The image shows a binary or grayscale representation of membership values for the first class. The brain's anatomical structure is visible, with lighter areas indicating higher membership values. The distribution of these values is somewhat noisy, reflecting the fuzzy nature of the membership function.	<p>Class 1 Membership</p>

Memmbership for second class with $q=5$



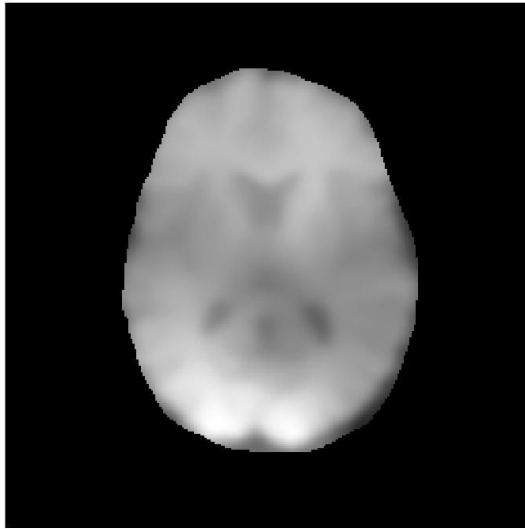
Class 2
Membership

Memmbership for third class with $q=5$



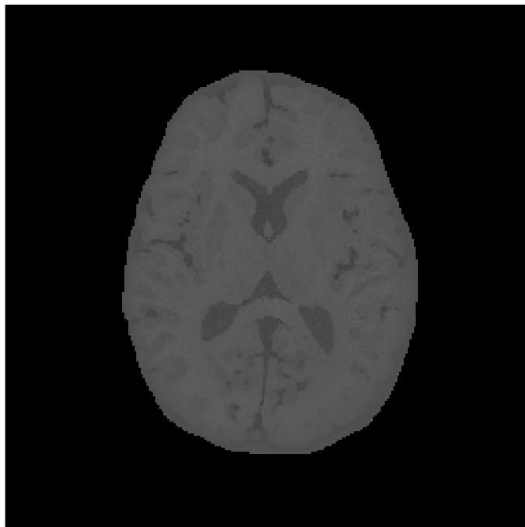
Class 3
Membership

Bias Field Estimates with $q=5$

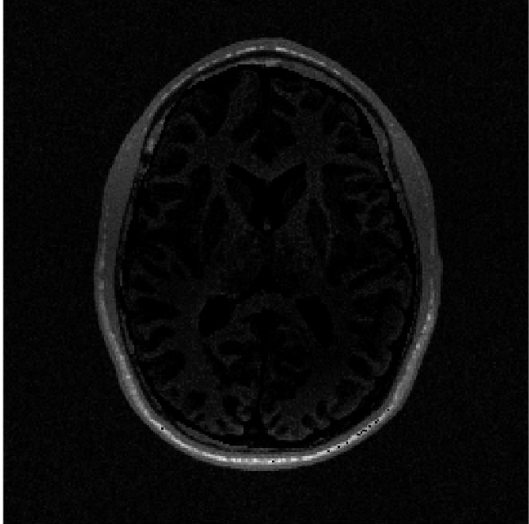


Optimal Bias
Field Image

Bias removed image with $q=5$



Optimal Bias
Removed Image

<p>Residual image with $q=5$</p>  A grayscale axial MRI scan of a human brain. The image shows the internal structure of the brain, including the cerebral cortex, white matter, and ventricles. The image is centered and occupies most of the left column's height. <p></p>	<p>Residual Image</p>
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Part g

Optimal Class means = [0.3058, 0.4991, 0.5765]

Disclaimer

All the above images in high resolution can be located in 'images' folder of corresponding question.